Coalescence of Sessile Drops

D. Beysens and V.S. Nikolayev
Service des Basses Températures
ESEME/SBT/CEA-Grenoble
F-38054 Grenoble Cedex 9, France

Y. Garrabos
Institut de Chimie de la Matière Condensée de Bordeaux
CNRS-Université Bordeaux 1
F-33608 Pessac Cedex, France

We present a study of the kinetics and morphology of the coalescence process of two hemispherical water drops on a plane surface in contact with nitrogen saturated with water. The drops slowly grow by condensation and eventually touch each other and coalesce (they form a *"Breath Figures"* pattern). A new convex composite drop is rapidly formed that then exponentially relaxes to a hemispherical drop. The relaxation time is proportional to the size of the drop and exceeds the characteristic hydrodynamic time by at least a factor of 10^4.

This result shows the importance of the triple (gas-liquid-solid) contact line region where bulk hydrodynamics breaks down. We present and discuss several theoretical approaches. First, we study the effect of defects on the solid surface in the frame of a 2D model. It is shown that, although the depinning of the contact line increases the relaxation time slightly, it fails to explain the factor 10^4. We propose a model based on Yu. Shikhmurzaev's approach that ignores the mass transfer through the gas-liquid interface. Finally, we analyze the consequences of a new model proposed by Y. Pomeau where, as proposed by P. Seppecher, a local evaporation-condensation occurs in the vicinity of the moving contact line. We compare these models with our experimental data.